KM3L

LIMIT CONTROLLER

Engineering Manual

24/02 - Code: ISTR_M_KM3L_E_00_--

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1. OUTLINE DIMENSIONS (mm)

1.1 Mounting requirements

This instrument is intended for permanent installation, for indoor use only, in an electrical panel which encloses the rear housing, exposed terminals and wiring on the back.

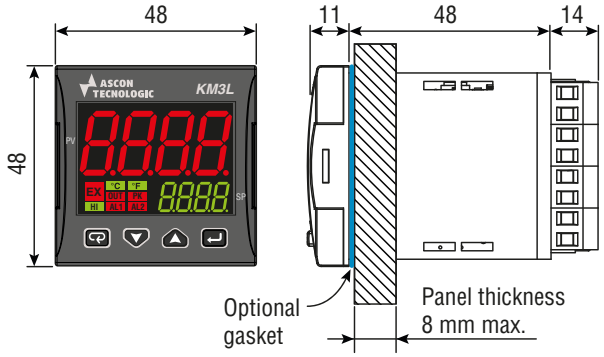
Select a mounting location having the following characteristics:

1. It should be easily accessible;
2. There is minimum vibrations and no impact;
3. There are no corrosive gases;
4. There are no water or other fluids (i.e. condensation);
5. The ambient temperature is in accordance with the operative temperature (0 to 50°C);
6. The relative humidity is in accordance with the instrument specifications (20 to 90%);

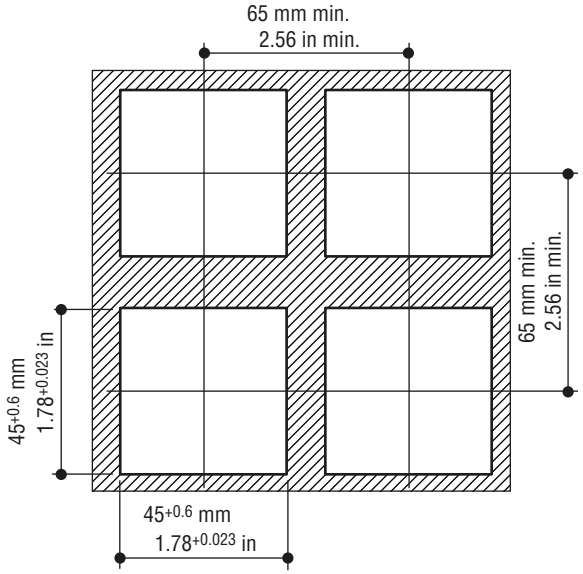
The instrument can be mounted on panel with a maximum thickness of 8 mm.

When the maximum front protection (IP65) is desired, the optional gasket must be mounted.

1.2 Instrument dimensions



1.3 Panel Cut-out

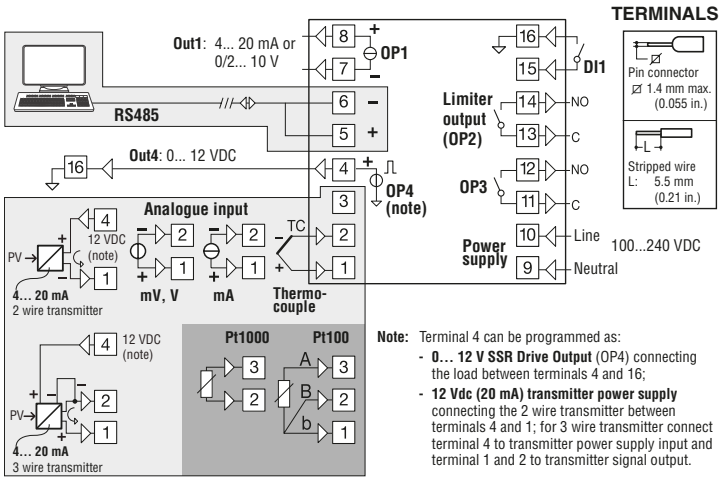


2. CONNECTION DIAGRAM

2.1 General notes about wiring

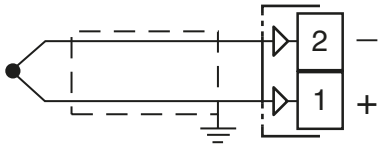
1. Do not run input wires together with power cables.
2. External components (like zener barriers, etc.) connected between sensor and input terminals may cause errors in measurement due to excessive and/or not balanced line resistance or possible leakage currents.
3. When a shielded cable is used, it should be connected at one point only.
4. Pay attention to the line resistance; a high line resistance may cause measurement errors.

2.2 Electrical connections



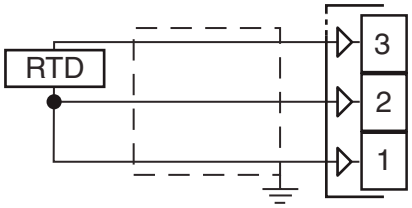
2.3 Inputs

2.3.1 Termocouple Input



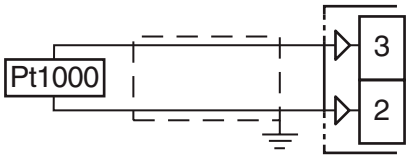
External resistance: 100Ω max., maximum error 25 µV.
Continuity detection current: 250 nA.
Cold junction: Automatic compensation between 0 to 50°C.
Cold junction accuracy: 0.05°C/°C after a warm-up of 20 minutes.
Input impedance: > 1 MΩ.
Burn out: full scale
Calibration: According to EN 60584-1.
Note: For TC wiring use proper compensating cable preferable shielded.

2.3.2 RTD Pt 100 Input



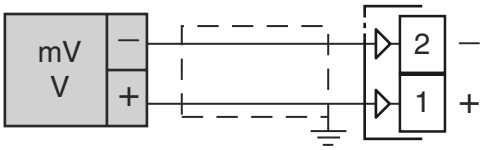
Input circuit: Current injection (135 µA).
Line resistance: Automatic compensation up to 20Ω/wire with maximum error ±0.03% of the input span.
Calibration: According to EN 60751/A2.
Note: The resistance of the 3 wires must be the same.

2.3.3 RTD Pt 1000 Input



Line resistance: Not compensated.
Pt 1000 input circuit: Current injection (15 µA).
Pt 1000 calibration: According to EN 60751/A2.

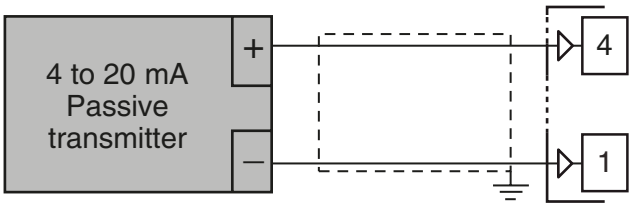
2.3.4 V and mV Input



Input impedance: > 1 MΩ for mV Input
500 kΩ for Volt Input.

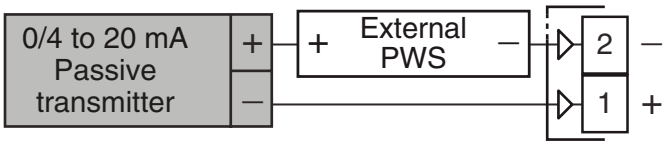
2.3.5 mA Input

0/4 to 20 mA input wiring for passive transmitter using the auxiliary pws

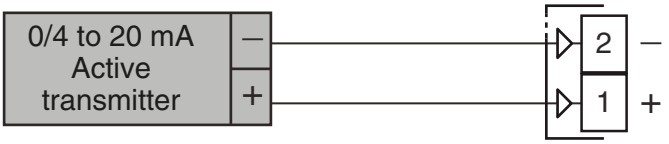


Input impedance: < 53Ω.
Internal auxiliary PWS: 12 VDC (±10%), 20 mA max..

0/4 to 20 mA input wiring for passive transmitter using an external pws



0/4 to 20 mA input wiring for active transmitter

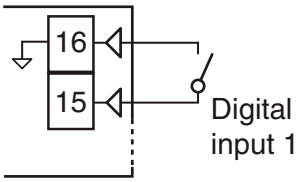


2.3.6 Logic Inputs

Safety notes:

– Do not run logic input wiring together with power cables;
– The instrument needs 150 ms to recognize a contact status variation;
– Logic inputs are **NOT** isolated by the measuring input. A double or reinforced isolation between logic inputs and power line must be assured by the external elements.

Logic inputs driven by dry contact



Maximum contact resistance: 100Ω.
Contact rating: DI1 = 10 V, 6 mA.

2.4 Outputs

Safety notes:

– To avoid electrical shocks, connect power line at last.
– For supply connections use No. 16 AWG or larger wires rated for at last 75°C.
– Use copper conductors only.
– SSR outputs are not isolated. A reinforced isolation must be assured by the external solid state relays.
– For SSR, mA and V outputs if the line length is longer than 30 m use a shielded wire.
– Do not short-circuit the terminals of the SSR output.

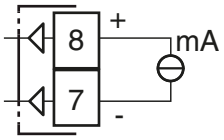
Before connecting the output actuators, we recommend to configure the parameters to suit your application (e.g.: input type, Control strategy, alarms, etc.).

2.4.1 Output 1 (OP1)

Function: retransmission

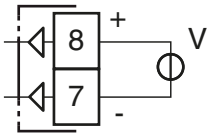
Output type: Isolated output.

Current Analog Output



mA output: 0/4... 20 mA, galvanically isolated, RL max. 600Ω.

Voltage Analog Output

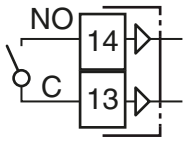


V output: 0/2... 10 V, galvanically isolated, RL min.: 500Ω.

2.4.2 Output 2 (OP2)

Function: Limiter output

Relay Output

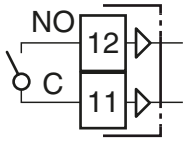


Contact rating: • 2 A /250 V cosφ = 1;
• 1 A /250 V cosφ = 0.4.

Operation: 1 x 10^5.

2.4.3 Output 3 (OP3)

Relay Output

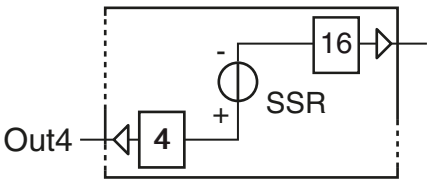


Contact rating: • 2 A /250 V cosφ = 1;
• 1 A /250 V cosφ = 0.4.

Operation: 1 x 10^5.

2.4.4 Output 4 (OP4)

SSR Output

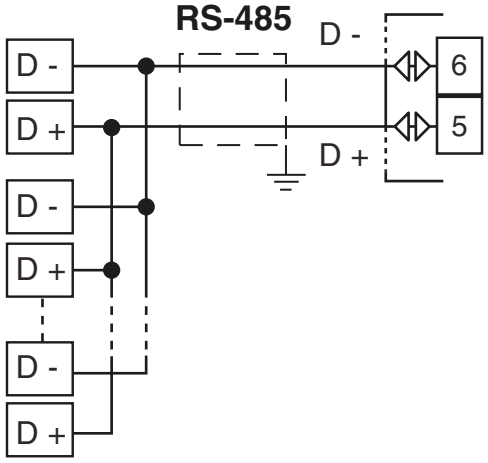


Logic level 0: Vout < 0.5 VDC;

Logic level 1: 12 V ±20%, 20 mA max..

Note: Overload protected.

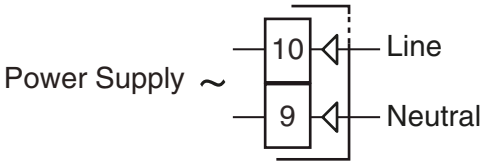
2.5 Serial Interface



Interface type: Isolated (50 V) RS-485;
Voltage levels: According to EIA standard;
Protocol type: Modbus RTU;
Byte format: 8 bit with no parity;
Stop bit: 1 (one);
Baud rate: Programmable between 1200 to 38400 baud;
Address: Programmable between 1 to 254.

Notes: **1.** RS-485 interface allows to connect up to 30 devices with one remote master unit.
2. The cable length must not exceed 1.5 km at 9600 baud.

2.6 Power Supply



Supply Voltage: 100 to 240 VAC (-15 to +10%).

Notes: **1.** Before connecting the instrument to the power line, make sure that line voltage is equal to the voltage shown on the identification label;
2. The polarity of the power supply has no importance;
3. The power supply input is NOT fuse protected. Please, provide a T type 1A, 250 V fuse externally.

3. TECHNICAL CHARACTERISTICS

3.1 Technical specification

Case: Plastic, self-extinguishing degree: V-0 according to UL 94;

Front protection: IP 65 (when the optional panel gasket is mounted) for indoor locations according to EN 60070-1;

Terminals protection: IP 20 according to EN 60070-1;

Installation: Panel mounting;

Terminal block: 16 screw terminals for cables of 0.25 to 2.5 mm^2 (AWG22 to AWG14) with connection diagram, tightening torque 0.5 Nm;

Dimensions: 48 x 48, depth 73 mm, (1.89 x 1.89 x 2.87 in.)

Panel cutout: $45^{[-0, +0.6]}$ x $45^{[-0, +0.6]}$ mm
($1.78^{[- 0.000, +0.023]}$ x $1.78^{[- 0.000, +0.023]}$ in.)

Weight: 180 g max..

Power supply: 100 to 240 VAC (-15 to +10% of the nominal value);

Power consumption: 6.0 VA max. (100 to 240 VAC);

Insulation voltage: 2300 Vrms according to EN 61010-1;

Display updating time: 500 ms;

Sampling time: 130 ms;

Resolution: 30000 counts;

Total Accuracy: ±0.5% F.S.V. ±1 digit @ 25°C of room temperature;

Electromagnetic compatibility and safety requirements

Compliance: directive EMC 2004/108/CE (EN 61326-1), directive LV 2006/95/CE (EN 61010-1), UL 61010-1 CSA 61010-1;

Note: During the test, the instrument continues to operate at the measurement accuracy within specification.

Installation category: II;

Pollution category: 2;

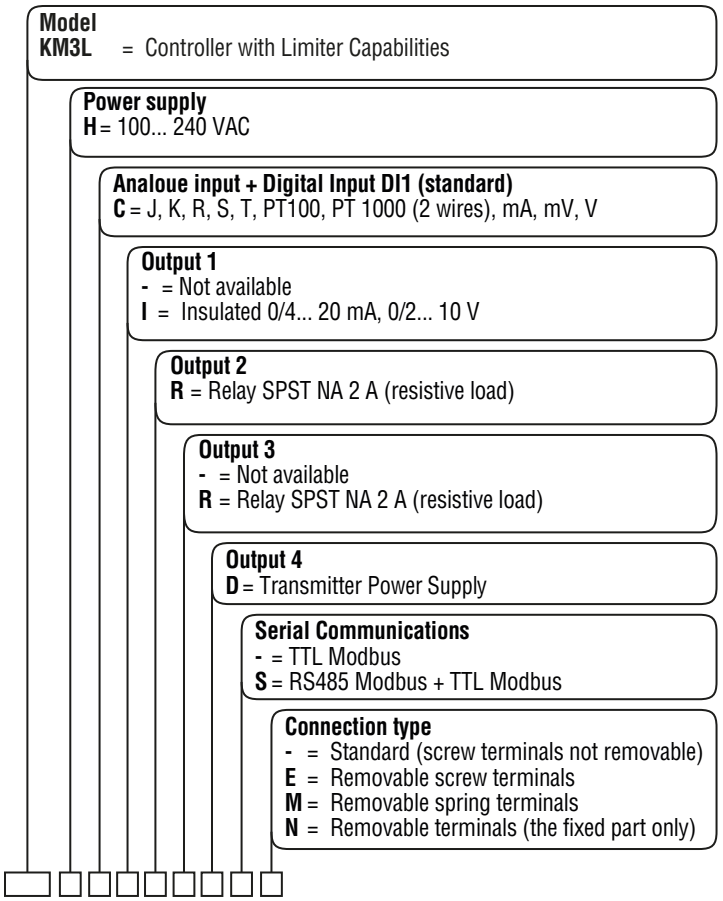
Temperature drift: It is part of the global accuracy;

Operating temperature: 0 to 50°C (32 to 122°F);

Storage temperature: -30 to +70°C (-22 to +158°F);

Humidity: 20 to 90% RH, not condensing.

4. MODEL AND SUFFIX CODES



5. CONFIGURATION PROCEDURE

5.1 Introduction

When the instrument is powered, it starts immediately to work according to the parameters values loaded in its memory.

The instrument behaviour and its performance are governed by the value of the stored parameters.

At the first start up the instrument will use a "default" parameter set (factory parameter set); this set is a generic one (e.g. a TC J input is programmed).

Before connecting the output actuators, we recommend to configure the parameters to suit your application (e.g.: input type, Control strategy, alarms, etc.).

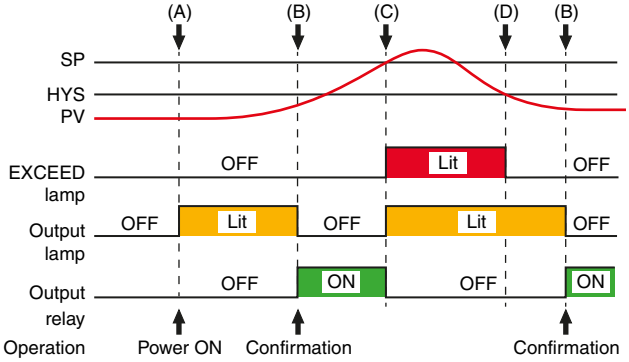
To change these parameters you need to enter the "*Configuration mode*".

5.2 Instrument behaviour at Power ON

At power ON the instrument can operate in 2 different modes according to the value assigned to **[34] r.md** parameter:

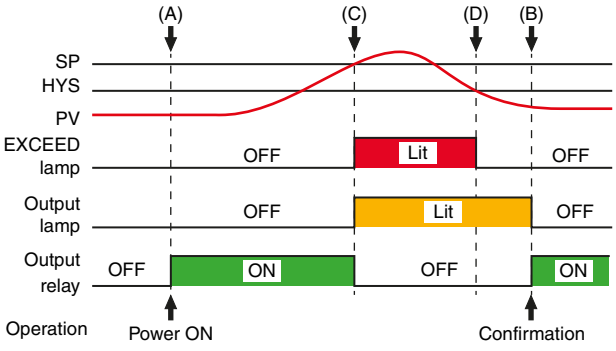
[34] r.md equal to 0 (Limit relay output is always de-energized at power ON)

The output relay is always de-energized (**open**) at power ON, even if **PV** does not exceed **SP** (**A**). The output (OUT) LED is **lit**. If **PV** does not exceed **SP**, after the Confirmation operation (**B**), the limit output relay (**Out 2**) will be energized (**closed**) and the output (OUT) LED turns OFF.



[34] r.md equal to 1 (Limit relay output energized at power ON)

At power ON the limit relay output is energized (**closed**) and the output (OUT) LED is **not lit** if the **PV** does not exceed **SP**.



5.3 Entering the "Configuration mode"

The configuration parameters are collected in various groups. Each group defines all parameters related with a specific function (e.g.: control, alarms, output functions).

1. Push the ↵ button for more than 3 seconds. The upper display will show PASS while the lower display shows 0.
2. Using ▲ and ▼ buttons set the programmed password.

Note: The factory default password for configuration parameters is 30.

3. Push the ↵ button. If the correct password has been inserted, the upper display will show the acronym of the first parameter group preceded by the symbol: ⊐.
   In other words the upper display shows: ⊐ InP
   (**Input parameters** group).

The instrument is in configuration mode.

5.4 How to exit the "Configuration mode"

Push ↩ button for more than 3 seconds, the instrument returns to the "*Standard display*".

5.5 Keyboard functions during parameter changing

↩ A short press allows to exit from the current parameter group and select a new parameter group.
A long press allows you to close the configuration parameter procedure (the instrument returns to the "*Standard display*").

↵ When the upper display is showing a group and the lower display is blank, this key allows to enter in the selected group.
When the upper display is showing a parameter and the lower display is showing its value, this key allows to store the selected value for the current parameter and access the next parameter within the same group.

▲ Allows to increase the value of the selected parameter.

▼ Allows to decrease the value of the selected parameter.

↩ + ↵ These two keys allow to return to the previous group. Proceed as follows:
Push the ↩ button and maintaining the pressure, then push the ↵ button; release both the buttons.

Note: The group selection is cyclic as well as the selection of the parameters in a group.

5.6 Factory reset - Default parameters loading procedure

Sometime, e.g. when you re-configure an instrument previously used by other people or for different purposes or when you have made too many errors during configuration and you decided to re-configure the instrument, it is possible to restore the factory configuration.

This action allows to put the instrument in a defined condition (the same it was at the first power ON).

The default data are those typical values loaded in the instrument prior to ship it from factory.

To load the factory default parameter set, proceed as follows:

1. Press the ↵ button for more than 5 seconds. The upper display will show PASS while the lower display shows 0;
2. Using ▲ and ▼ buttons set the value -48 1;
3. Push ↵ button;
4. The instrument will turn OFF all LEDs for a few seconds, then the upper display will show dFLt (default) after that all LEDs are turned ON for 2 seconds. At this point the instrument restarts as for a new power ON.

The procedure is complete.

Note: The complete list of the default parameters is available in Appendix A.

5.7 Configuring all parameters

In the following pages we will describe all the parameters of the instrument. However, the instrument only shows the parameters applicable to its hardware options in accordance with the specific instrument configuration (i.e. setting AL 1t [Alarm 1 type] to nonE [not used], all parameters related to alarm 1 will be skipped).

inP Group - Main and auxiliary input configuration

[1] SEnS - Input type

Available: Always.

Range:

J	TC J	(-50... +1000°C/-58... +1832°F);
crAL	TC K	(-50... +1370°C/-58... +2498°F);
S	TC S	(-50... 1760°C/-58... +3200°F);
r	TC R	(-50... +1760°C/-58... +3200°F);
t	TC T	(-70... +400°C/-94... +752°F);
n	TC N	(-50 ...+1300°C/-58...+2372°F)
Pt1	RTD Pt100	(-200... +850°C/-328... +1562°F);
Pt10	RTD Pt1000	(-200... +850°C/-328... +1562°F);
0.60	0... 60 mV linear;	
12.60	12... 60 mV linear;	
0.20	0... 20 mA linear;	
4.20	4... 20 mA linear;	
0.5	0... 5 V linear;	
1.5	1... 5 V linear;	
0.10	0... 10 V linear;	
2.10	2... 10 V linear.	

Notes:
1. When a TC input is selected and a decimal figure is programmed (see the next parameter) the max. displayed value becomes 999.9°C or 999.9°F.
2. All changes to SEnS parameter setting force parameter [2] dP = 0 and change all parameters related with dP (e.g. Set Points, Alarms threshold, etc.).

[2] dP - Decimal point position

Available: Always.

Range: 0 to 3 When [1] SenS = Linear input;
0 or 1 When [1] SenS different from a linear input.

Note: All changes to dP parameter setting produce a change of all parameters related with it (e.g.: Set Points, Alarm threshold, etc.).

[3] SSc - Initial scale read-out for linear inputs

Available: When a linear input is selected by [1] SenS.

Range: -1999 to 9999.

Notes:
1. SSc allows the scaling of the analog input to set the minimum displayed/measured value. The instrument is able to display the measured value until it reaches a value of 5% lower than SSc, below which shows the Underrange message.
2. It is possible to set a initial scale read-out higher then the full scale read-out in order to obtain a reverse read-out scaling.
   E.g.:
   0 mA = 0 mBar and 20 mA = -1000 mBar (vacuum).

[4] FSc - Full scale read-out for linear input

Available: When a linear input is selected by [1] SenS.

Range: -1999 to 9999.

Notes:
1. Fsc allows the scaling of the analog input to set the maximum displayed/measured value. The instrument is able to display the measured value until it reaches a value of 5% higher than FSc, above which shows the Overrange message.
2. It is possible to set a full scale read-out lower than the initial scale read-out in order to obtain a reverse read-out scaling.
   E.g.:
   0 mA = 0 mBar and 20 mA = -1000 mBar (vacuum).

[5] unit - Engineering unit

Available: When a temperature sensor is selected by [1] SenS parameter.

Range: °C Celsius;
°F Fahrenheit.

[6] FiL - Digital filter ON the measured value

Available: Always.

Range: oFF (No filter);
0.1 to 20.0 s.

Note: This is a first order digital filter applied ON the measured value. For this reason it will affect the measured value but also the control action and the alarms behaviour.

[7] bS - PV input bias

Available: Always.

Range: In Engineering Units. Programmable from -100% to +100% of the input span.

[8] di.A - Digital Inputs Action

Available: Always.

Range: 0 DI1 Direct action (transition open -> close);
1 DI1 Reverse action (transition closed -> open).

out Group - Output parameters

[9] o1.t - Out 1 type

Available: When the out 1 is present.

Range: 0-20 0 to 20 mA;
4-20 4 to 20 mA;
0-10 0 to 10 V;
2-10 2 to 10 V.

[10] o1.F - Out 1 function

Available: Always.

Range: nonE Output not used;
r.inP Measured value Analog retransmission;
r.Err Measured error (PV-SP) analog retransmission;
r.SP Operative Set Point analog retransmission;
r.SEr Analog retransmission of a value coming from serial link.

[11] A.o1L - Initial scale value of the analog retransmission

Available: When Out 1 is present

Range: -1999 to [12] Ao1H.

[12] A.o1H - Full scale value of the analog retransmission

Available: When Out 1 is present.

Range: [11] Ao1L to 9999.

[13] o3F - Out 3 function

Available: When the instrument has out 3 option.

Range: nonE Output not used. With this setting the status of this output can be driven directly from serial link;
AL Alarm output;
or.bo Out-of-range or burn out indicator;
P.FAL Power failure indicator;
bo.PF Out-of-range, burn out and Power failure indicator.

[14] o3.AL - Alarms linked up with Out 3

Available: When [13] o3F = AL.
Range: 0 to 15 with the following rule:
+1 Alarm 1;
+2 Alarm 2;
+4 Sensor break (burn out);
+8 Overload ON Out 4 (short circuit ON OP 4).
Example: Setting 3 (2 + 1) the output is driven by alarms 1 and 2 (OR condition).

[15] o3Ac - Out 3 action

Available: When [13] o3F is different from "nonE".
Range: dir Direct action;
rEU Reverse action;
Notes: **1.** Direct action: the output repeats the status of the driven element. Example: the output is an alarm output with direct action. When the alarm is ON, the relay will be energized (logic output 1).
2. Reverse action: the output status is the opposite of the status of the driven element. Example: the output is an alarm output with reverse action. When the alarm is OFF, the relay will be energized (logic output 1).
This setting is usually named "fail-safe" and it is generally used in dangerous process in order to generate an alarm when the instrument power supply goes OFF or the internal watchdog starts.

[16] o4F - Out 4 function

Available: Always.
Range: nonE Output not used. With this setting the status of the this output can be driven directly from serial link.
AL Alarm output;
or.bo Out-of-range or burn out indicator;
P.FAL Power failure indicator;
bo.PF Out-of-range, burn out and Power failure indicator;
ON Output always ON (Out 4 is used to supply the transmitter).

[17] o4.AL - Alarms linked up with Out 4

Available: When [16] o4F = AL.
Range: 0 to 15 with the following rule.
+1 Alarm 1;
+2 Alarm 2;
+4 Sensor break (burn out);
+8 Overload ON Out 4 (short circuit ON OP4).
For more details see [14] o3.AL parameter.

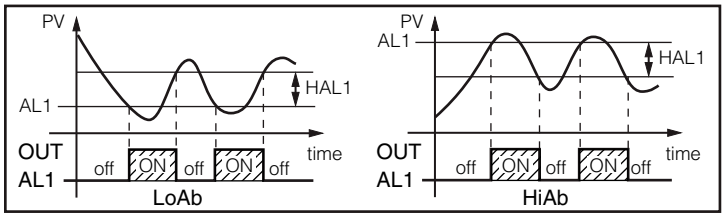
[18] o4Ac - Out 4 action

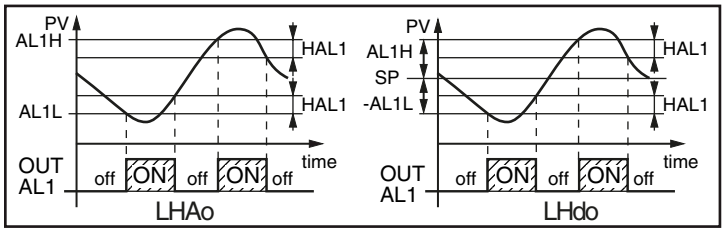
Available: When [16] o4F is different from "nonE".
Range: dir Direct action;
rEU Reverse action;.
For more details see [15] o4.Ac parameter.

AL1 Group - Alarm 1 parameters

[19] AL1t - Alarm 1 type

Available: Always.
Range: When one or more outputs are programmed as control output:
nonE Alarm not used;
LoAb Absolute low alarm;
HiAb Absolute high alarm;
LHAo Absolute band alarm with alarm indication out of the band;
LHAi Absolute band alarm with alarm indication inside the band;
SE.br Sensor break;
LodE Deviation low alarm (relative);
HidE Deviation high alarm (relative);
LHdo Relative band alarm with alarm indication out of the band;
LHdi Relative band alarm with alarm indication inside the band.
Notes: **1.** The relative and deviation alarms are "relative" to the operative Set Point value.

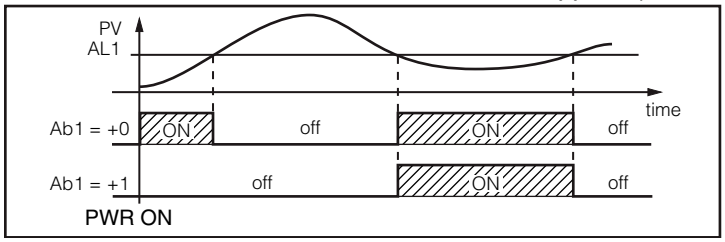




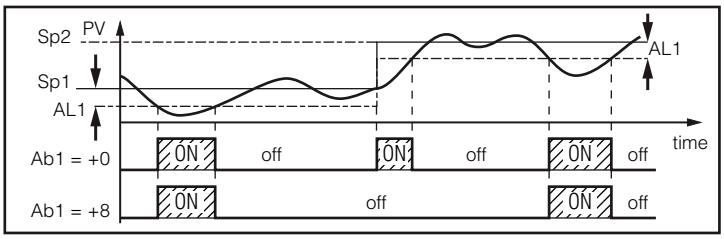
2. The (SE.br) sensor break alarm will be ON when the display shows - - - - indication.

[20] Ab1 - Alarm 1 function

Available: When [28] AL1t is different from "nonE".
Range: 0 to 3 with the following rule:
+1 Not active at power up;
+2 Relative alarm not active at Set Point change.
Notes: **1.** The "not active at power up" selection allows to inhibit the alarm function at instrument power up The alarm will be automatically enabled when the measured value reaches, for the first time, the alarm threshold ±hysteresis (in other words, when the initial alarm condition disappears).



2. A "relative alarm not active at Set Point change" is an alarm that masks the alarm condition after a Set Point change until process variable reaches the alarm threshold ±hysteresis.



3. The instrument does not store in EEPROM the alarm status. For this reason, the alarm status will be lost if a power down occurs.

[21] AL1L - For high and low alarms AL1L is the low limit of the AL1 threshold
- For band alarm is low alarm threshold

Available: When [19] AL1t is different from “nonE” or [19] AL1t is different from “SE.br”.

Range: From -1999 to [22] AL1H Engineering Units.

[22] AL1H - For high and low alarms AL1H is the high limit of the AL1 threshold
- For band alarm is the high alarm threshold

Available: When [19] AL1t is different from “nonE” or [19] AL1t is different from “SE.br”.

Range: From [21] AL1L to 9999 Engineering Units.

[23] AL1 - Alarm 1 threshold

Available: When:
[19] AL1t = LoAb - Absolute low alarm;
[19] AL1t = HiAb - Absolute high alarm;
[19] AL1t = LodE - Deviation low alarm (relative);
[19] AL1t = HIdE - Deviation high alarm (relative).

Range: From [21] AL1L to [22] AL1H Engineering Units.

[24] HAL1 - Alarm 1 hysteresis

Available: When [19] AL1t is different from “nonE” or [19] AL1t is different from “SE.br”.

Range: 1 to 9999 Engineering Units.

Notes: 1. The hysteresis value is the difference between the Alarm threshold value and the point the Alarm automatically resets.

2. When the alarm threshold plus or minus the hysteresis is out of input range, the instrument will not be able to reset the alarm.

Example: Input range 0 to 1000 (mBar).

– Set point equal to 900 (mBar);

– Deviation low alarm equal to 50 (mBar);

– Hysteresis equal to 160 (mBar) the theoretical reSet Point is 900 - 50 + 160 = 1010 (mBar) but this value is out of range. The reset can be made only by turning the instrument OFF, removing the condition that generate the alarm and then turn the instrument ON again;

– All band alarms use the same hysteresis value for both thresholds;

– When the hysteresis of a band alarm is bigger than the programmed band, the instrument will not be able to reset the alarm.

[25] AL1d - Alarm 1 delay

Available: When [19] AL1t is different from “nonE”.

Range: From oFF (0) to 9999 seconds.

Note: The alarm goes ON only when the alarm condition persists for a time longer than [25] AL1d time but the reset is immediate.

AL2 Group - Alarm 2 parameters

[26] AL2t - Alarm 2 type

Available: Aways.

Range: When one or more outputs are programmed as control output:
nonE Alarm not used;
LoAb Absolute low alarm;
HiAb Absolute high alarm;
LHAo Absolute band alarm with alarm indication out of the band;
LHAi Absolute band alarm with alarm indication inside the band;
SE.br Sensor break;
LodE Deviation low alarm (relative);
HidE Deviation high alarm (relative);
LHdo Relative band alarm with alarm indication out of the band;
LHdi Relative band alarm with alarm indication inside the band;

Note: The relative alarm are “relative” to the operative Set Point value

[27] Ab2 - Alarm 2 function

Available: When [36] AL2t is different from “nonE”.

Range: 0 to 3 with the following rule:
+1 Not active at power up;
+2 Relative alarm not active at Set Point change.

Note: For other details see [20] Ab1 parameter.

[28] AL2L - For high and low alarms AL2L is the low limit of the AL2 threshold
- For band alarm is low alarm threshold

Available: When [26] AL2t is different from “nonE” or [26] AL2t is different from “SE.br”.

Range: -1999 to [29] AL2H Engineering Units.

[29] AL2H - For high and low alarms AL2H is the high limit of the AL2 threshold
- For band alarm is the high alarm threshold

Available: When [26] AL2t is different from “nonE” or [26] AL2t is different from “SE.br”.

Range: From [28] AL2L to 9999 Engineering Units.

[30] AL2 - Alarm 2 threshold

Available: When:
[26] AL2t = LoAb Absolute low alarm;
[26] AL2t = HiAb Absolute high alarm;
[26] AL2t = LodE Deviation low alarm (relative);
[26] AL2t = HIdE Deviation high alarm (relative).

Range: From [28] AL2L to [29] AL2H Engineering Units.

[31] HAL2 - Alarm 2 hysteresis

Available: When [26] AL2t is different to “nonE” or [26] AL2t is differ2nt from “SE.br”.

Range: 1 to 9999 Engineering Units.

Note: For other details see [24] HAL1 parameter.

[32] AL2d - Alarm 2 delay

Available: When [26] AL2t different form “nonE”.

Range: From oFF (0) to 9999 seconds.

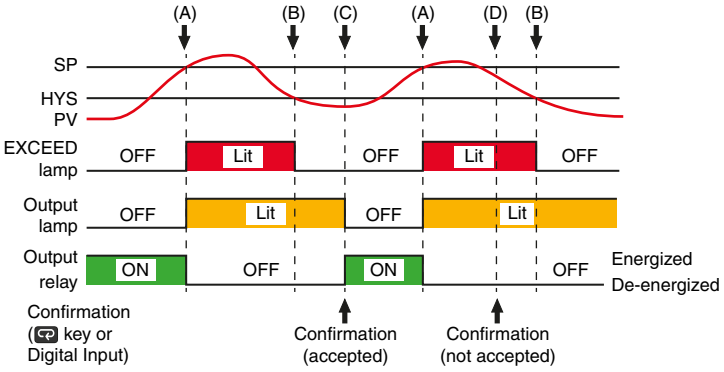
Note: The alarm goes ON only when the alarm condition persist for a time longer than [32] AL2d time but the reset is immediate.

rEG group - Control parameters

[33] Hi.Lo - Limit Control type

Available: Aways.
Range: Hi High limiter;
Lo Low limiter.

High limit control (HI LED lit)



When the measured value (**PV**) exceeds the Set Point (**SP**), the EXCEED [EX] and output [OUT] LEDs turn ON and the **limit relay output** (**Out 2**) is **de-energized**.

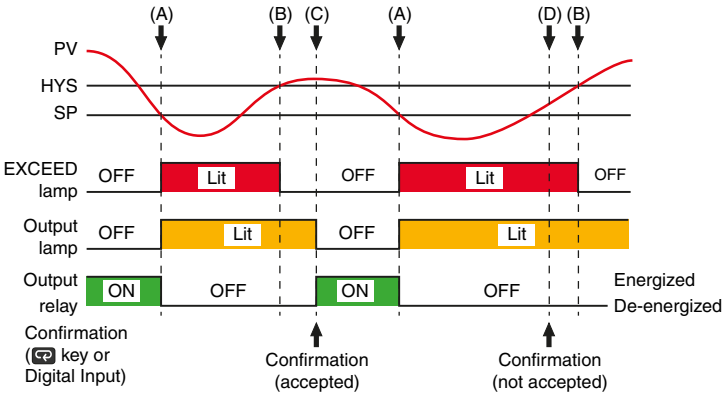
EX LED turns OFF when **PV** returns in normal condition, while the output OUT LED remains ON (**B**). The output OUT LED turns OFF when a **Confirmation operation** (*rearm*) is done by the operator. The **Confirmation operation** (*rearm*) can be done according to the d i5 parameter setting:

- By pressing key;
- By closing the Digital Input.

When the EX LED is **ON** and **PV** is lower than **SP**, but **inside** the **Hysteresis area**, the upper display is shown in **green**.

The **Confirmation operation** is not accepted while the EX LED is lighted (**D**)(while **PV** exceeds **SP** or when **PV** is in the Hysteresis area after EX has been triggered). The **relay output** is **de-energized** whenever the OUT LED is ON.

Low limit control



When the measured value (**PV**) exceeds the Set Point (**SP**), the EXCEED [EX] and output [OUT] LEDs **turn ON** and the **limit relay output** (**Out 2**) is **de-energized**.

EX LED turns OFF when **PV** returns in normal condition, while the output OUT LED remains ON (**B**). The output OUT LED turns OFF when a **Confirmation operation** (*rearm*) is done by the operator. The **Confirmation operation** (*rearm*) can be done according to the d i5 parameter setting:

- By pressing key;
- By closing the Digital Input.

When the EX LED is **ON** and **PV** is lower than **SP**, but **inside** the **Hysteresis area**, the upper display is shown in **green**.

The **Confirmation operation** is not accepted while the EX LED is lighted (**D**)(if **PV** exceeds **SP** or when **PV** is in the Hysteresis area after EX has been triggered). The **relay output** is **de-energized** whenever the OUT LED is ON.

[34] r.md - Limit output status at power ON

Available: Always.
Range: on Limit output is ON in any case;
oFF Limit output is OFF at power ON when PV does not exceed SP.

[35] HYS - Limit output Hysteresis

Available: Always.
Range: In Engineering Units from 0 to 100% of the input span.

[36] oP.SL - Operating display selection

Available: Always.
Range: 0 PV (upper display) and SP (lower display);
1 SP only.
Note: Setting [36] oP.SL equal to 1, the instrument will not show the measured value and, in operator mode, the upper display will be blank.

[37] SPLL - Minimum Set Point value

Available: Always.
Range: From -1999 to [38] SPHL in Engineering Units.
Note: Changing the [37] SPLL value, the instrument checks the local Set Points (SP parameters).
If SP is out of this range, the instrument forces it to the maximum acceptable value.

[38] SPHL - Maximum Set Point value

Available: Always.
Range: From [37] SPLL to 9999 Engineering Units.
Note: For more details see [37] SPLL parameter.

[39] SP - Set Point 1

Available: Always.
Range: From [37] SPLL to [38] SPHL in Engineering Units.

[40] diS - Method of confirmation operation (rearm)

Available: Always.
Range: but By keyboard through key;
di By digital input.

[41] tim - Duration of the last EXCEED period

Available: Always but it is a Read Only parameter.
Range: From 00.00 to 99.59 (hh.mm).

[42] Hi- Maximum measured value (PK LED lit)

Available: When [33] Hi.Lo = Hi (high limit alarm) but it is a Read Only parameter.
Range: Engineering unit within the input range.

[43] Lo - Minimum measured value (PK LED lit)

Available: When [33] Hi.Lo = Lo (low limit alarm) but it is a Read Only parameter.
Range: Engineering unit within the input range.

PAn group - Operator HMI

[44] PAS2 - Level 2 password: Limited access level

Available: Always.
Range: oFF Level 2 not protected by password (as level 1 = Operator level);
1 to 200.

[45] PAS3 - Level 3 password: Complete configuration level

Available: Always.
Range: 3 to 200.
Note: Setting [144] PAS2 equal to [45] PAS3, Level 2 will be masked.

[46] di.CL - Display colour

Available: Always.
Range: 0 The upper display colour is used to point out the EXCEED condition:
- When **no exceed** condition is present the upper digits are shown in **green**;
- When a **Hi or Low exceed** condition is detected the upper digits are shown in **red**.

1 Display red (fix);
2 Display green (fix);
3 Display orange (fix).

[47] diS.t - Display timeout

Available: Always.
Range: oFF The display is always ON;
0.1 to 99.59 minutes and seconds.
Note: This function allows to turn OFF the display when no alarm is present and no action is made ON the instrument.
When d iSt is different than OFF and no button is pressed for more than the programmed time out, the display goes OFF and only 4 segments of the less significant digit are turned ON in sequence in order to show that the instrument is working correctly.
If an alarm occurs or a button is pressed, the display returns to normal operation.

Ser group - Serial link parameter

[48] Add - Instrument address

Available: Always.
Range: oFF Serial interface not used;
1 to 254.

[49] bAud - Baud rate

Available: When [131] Add different from oFF.
Range: 1200 1200 baud;
2400 2400 baud;
9600 9600 baud;
19.2 19200 baud;
38.4 38400 baud.

CAL group - User calibration group

This function allows to calibrate the complete measuring chain and to compensate the errors due to:
– Sensor location;
– Sensor class (sensor errors);
– Instrument accuracy.

[50] A.L.P - Adjust Low Point

Available: Always.
Range: -1999 to (AH.P - 10) Engineering Units.
Note: The minimum difference between AL.P and AH.P is equal to 10 Engineering Units.

[51] A.L.o - Adjust Low Offset

Available: Always.
Range: -300 to +300 in Engineering Units.

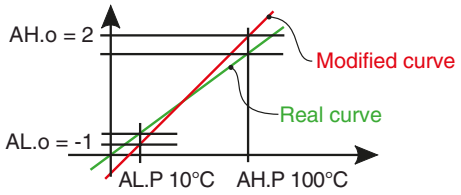
[52] A.H.P - Adjust High Point

Available: Always.
Range: From (AL.P + 10) to 9999 Engineering Units.
Note: The minimum difference between AL.P and AH.P is equal to 10 Engineering Units.

[53] A.H.o - Adjust High Offset

Available: Always.
Range: -300 to +300 in Engineering Units.
Example: Environmental chamber with operative range: 10 to 100°C.

1. Insert in the chamber a reference sensor connected with a reference instrument (usually a calibrator).
2. Start the instrument control and set the Set Point equal to the minimum value of the operative range (e.g.: 10°C). When the temperature in the chamber is steady, take note of the temperature measured by the reference system (e.g.: 9°C).
3. Set [139] A.L.P = 10 (low working point) and [51] A.L.o = -1 (the difference between the instrument and the reference system readings). Note that after this set the measured value of the instrument is equal to the measured value of the reference system.
4. Now change the Set Point to the maximum value of the operative range (e.g. 100°C). When the temperature in the chamber is steady, take note of the temperature measured by the reference system (e.g. 98°C).
5. Set [141] A.H.P = 100 (high working point) and [53] A.H.o = +2 (the difference between the instrument and the reference system readings). Note that after this set the measured value of the instrument is equal to the measured value of the reference system.



The most important step of the configuration procedure is completed.

In order to exit from configuration parameter procedure, proceed as follows:

- Push [SET] button.
- Push [SET] button for more than 3 s. The instrument returns to the "*Standard display*".

6. OPERATIVE MODES

The KM3L is an FM (both FM3545 and FM3810) approved limit controller that can be configured either as a "**High limit**" or as a "**Low limit**" controller by the user.

The **Output 2** relay operates in **fail-safe mode** (relay de-energized during shutdown condition) and **latching mode**.

Output 2 turns OFF (in this document this condition is called shoutdown) **when**:

- The instrument is configured as a High limiter (Hi.Lo = Hi - the HI LED is **lit**) and the measured value **PV** is higher than the limiter threshold ["**SP**" parameter];
- The instrument is configured as a low limiter (Hi.Lo = Lo) - the HI LED is **not lit**) and the measured value **PV** is lower than the limiter threshold ["**SP**" parameter].

Output 2 remains **OFF** until the condition that generated the shutdown has been removed and the **Confirmation operation** (*rearm*) has been performed.

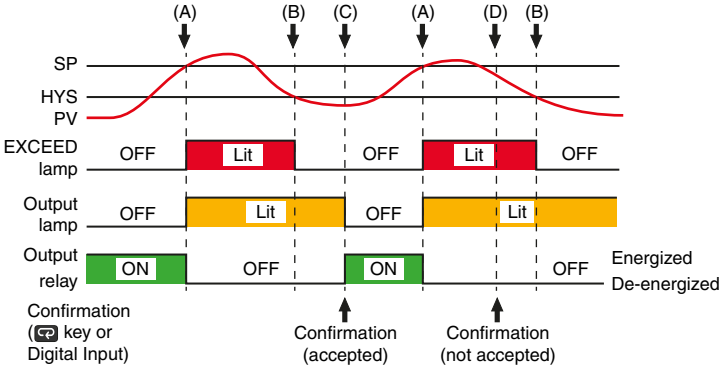
The **Confirmation operation** (*rearm*) can be performed by pressing the key or by momentarily closing the digital input (by an external dry contact) and will be accepted only when the condition that generated the shutdown no longer exists (EX not lit).

The duration of the shutdown condition stored by the instrument is **the time from** the **moment Out2 goes OFF** (shutdown start) **until the end of the event that caused the shutdown**.

The **Confirmation action** is not part of this time count.

The S*hutdown duration* and *max./min. measured values* are stored in memory and available for viewing (see "*Normal Display Mode*") until the next shutdown condition occurs. These informations are lost at power down.

High limit control (HI LED lit)



When the measured value (**PV**) becomes higher than the Set Point (**SP**) value, the EXCEED [EX] and output [OUT] LEDs **turn ON** and the **limit relay output** (**Out 2**) is **de-energized**.

EX LED **turns OFF** when **PV** returns in normal condition, while the OUT LED remains **ON** (**B**) until a **Confirmation operation** (*rearm*) is done by the operator (**C**).

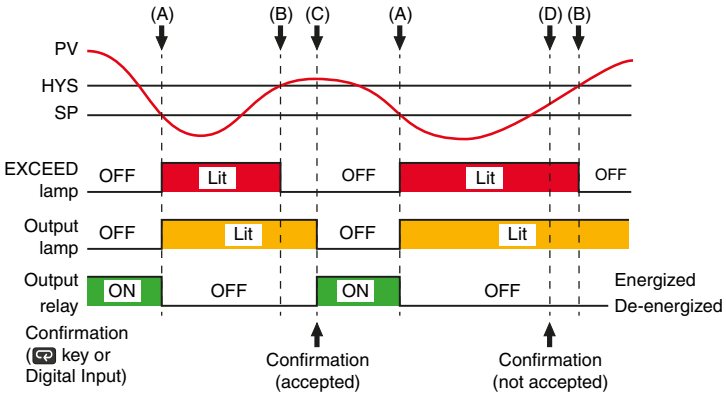
The **Confirmation operation** (*rearm*) can be done according to the d.5 parameter setting:

- By pressing key;
- By closing the Digital Input.

When the EX LED is **ON** and **PV** is lower than **SP**, but **inside** the **Hysteresis area**, the upper display is shown in **green**.

The **Confirmation operation** is not accepted while the EX LED is lighted (**D**)(if **PV** exceeds **SP** or when **PV** is in the Hysteresis area after EX has been triggered). The **relay output** is **de-energized** whenever the OUT LED is ON.

Low limit control



When the measured value (**PV**) becomes lower than the Set Point (**SP**) value, the EXCEED [EX] and output [OUT] LEDs **turn ON** and the **limit relay output** (**Out 2**) is **de-energized**.

EX LED **turns OFF** when **PV** returns in normal condition, while the OUT LED remains **ON** (**B**) until a **Confirmation operation** (*rearm*) is done by the operator (**C**).

The **Confirmation operation** (*rearm*) can be done according to the d.5 parameter setting:

- By pressing key;
- By closing the Digital Input.

When the EX LED is **ON** and **PV** is higher than **SP**, but **inside** the **Hysteresis area**, the upper display is shown in **green**.

The **Confirmation operation** is not accepted while the EX LED is lighted (**D**)(if **PV** exceeds **SP** or when **PV** is in the Hysteresis area after EX has been triggered). The **relay output** is **de-energized** whenever the OUT LED is ON.

6.1 Access levels and specific parameters

The instrument is showing the "*Standard display*".

This instrument is equipped with 3 different access levels:

- Level 1 – Operator Mode (not protected by password);
- Level 2 – Operator modify parameter (protected by a programmable password [default 20]);
- Level 3 – Configuration parameters mode (protected by programmable password [default 30]).

6.1.1 Level 1 - Operator mode

The operator mode (Level 1) allows: **Confirmation action**, to **see and reset** the **tin** parameter (time duration of the last shutdown condition detected) and to **see and reset** the **min/max** values(minimum or maximum measured value during the last shutdown condition detected).

Note: When a new shutdown condition is detected, the instrument automatically resets **tin** and **min/max** values and start to store the values related with the new shutdown condition only. At the end of the shutdown condition **tin** and **min/max** can be read and reset.

6.1.2 Level 2 - Operator modify parameter

The Level 2 area encompasses the following parameters:

Parameter	Description	Dec. point
SP	Shutdown Set Point	
AL 1L	For High and Low alarm it is the low limit of the AL1 1threshold	dP
	For band alarm, it is low alarm threshold	dP
AL 1H	For hight or low alarm, it is the high limit of AL1 threshold	dP
	For band alarm, it is high alarm threshold	dP
AL 1	Alarm 1 threshold	dP
AL2L	For High and Low alarm it is the low limit of the AL2 threshold	dP
	For band alarm, it is low alarm 2 threshold	dP
AL2H	For hight or low alarm, it is the high limit of AL2 threshold	dP
	For band alarm, it is high alarm 2 threshold	dP
AL2	Alarm 2 threshold	dP
HYS	Hysteresis of the shutdown control.	dp
F iL	Digital filter ON the measured value	
bS	PV input bias	

6.1.3 Level 3 - Configuration parameters mode

The Level 3 area includes all configuration parameters.

Note: All Level 3 parameters can be seen but not modified using password: - 181.

6.2 Entering the Level 2 mode (Operator Modify Parameter)

While the instrument is in "*Standard display*".

1. Press the [↵] button for more than 3 seconds;
2. The upper display will show PASS while the lower display shows 0;
3. By [▲] and [▼] buttons set the value assigned to [44] PAS2 (Level 2 password).

Notes:

1. The factory default password for configuration parameters is equal to 20.
2. All parameter changes are protected by a timeout. If no button is pressed for more than 10 s the instrument automatically returns to the *Standard display*, the new value of the last selected parameter is lost and the change parameter procedure is closed.

   When you desire to remove the time out (e.g. for the first configuration of an instrument) you can use a password equal to 1000 plus the programmed password (e.g. 1000 + 20 [default] = 1020).

   It is always possible to manually end the parameter configuration procedure (see below).
3. Push [↵] button.
4. The instrument will show ON the upper display the acronym of the first parameter promoted to this level and ON the lower display its value.
5. By [▲] and [▼] buttons assign to this parameter the desired value.
6. Press the [↵] button in order to memorize the new value and go to the next parameter.
7. When you want to come back to the "*Standard display*" push the [↩] button for more than 3 s.

6.3 How to see but not modify the Level 3 mode parameters (Configuration parameters)

Sometimes it is necessary to give the operator the possibility of seeing the value assigned to the configuration parameters level but, it is important that all changes are made by authorized personnel only

In this cases, proceed as follows:

1. Press the [↵] button for more than 3 seconds;
2. The upper display will show PASS while the lower display will show 0;
3. By [▲] and [▼] button set the value - 181;
4. Press [↵] button;
5. The upper display will show the acronym of the first level 3 parameter and lower display will show its value;
6. Using [↵] button it is possible to see the value assigned to all parameter present in level 3 but no changes are allowed;
7. It is possible to return to the "*Standard display*" by pressing the [↩] button for more than 3 seconds or by pressing no buttons for more than 10 seconds.

7. ERROR MESSAGES

7.1 Out of range signals

The upper display shows the OVER-RANGE and UNDER-RANGE conditions with the following indications:

Over-range

Under-range

The sensor break will be signalled as an out of range

Note: When an over-range or an under-range is detected, the alarms operate as in presence of the maximum or the minimum measurable value respectively.

To check the out of span Error condition, proceed as follows:

1. Check the input signal source and the connecting line.
2. Make sure that the input signal is in accordance with the instrument configuration. Otherwise, modify the input configuration (see **[1] sens** parameter).
3. If no error is detected, send the instrument to your supplier to be checked.

7.2 List of possible errors

ouLd Overload on **out 4**
The messages shows that a short circuit is present on Output 4 when it is used as a transmitter power suply. When the short circuit disappears the output restarts to operate.

ErEP Possible problem of the instrument memory.
The messages disappears automatically.
When the error continues, send the instrument to your supplier.

roME Possible problem of the firmware memory.
When this error is detected, send the instrument to your supplier.

Err t Possible problem of the calibration memory.
When this error is detected, send the instrument to your supplier.

8. GENERAL NOTES

8.1 Proper use

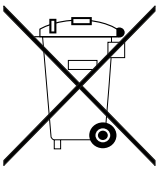
Every possible use not described in this manual must be consider as a improper use.

This instrument is in compliance with EN 61010-1 “Safety requirements for electrical equipment for measurement, control and laboratory use”; for this reason it coud not be used as a safety equipment.

Ascon Electronic and its legal representatives do not assume any responsibility for any damage to people, things or animals deriving from violation, wrong or improper use or in any case not in compliance with the instrument’s features.

Whenever a failure or a malfunction of the control device may cause dangerous situations for persons, thing or animals, please remember that the plant has to be equipped with additional safety devices.

8.2 Disposal



The appliance (or the product) must be disposed of separately in compliance with the local standards in force on waste disposal.

9. WARRANTY

This product is under warranty against manufacturing defects or faulty materials that are found within 18 months from manufacturing date. The warranty is limited to the replacement of the instrument.

The tampering of the instrument or an improper use of the product will bring about the immediate withdrawal of the warranty’s effects.

In the event of a faulty instrument, either within the period of warranty, or further to its expiry, please contact our sales department to obtain authorisation for sending the instrument to our company.

Appendix A

inP group - Main and auxiliary input configuration

no.	Param.	Description	Dec. Point	Values	Default
1	SEnS	Sensor selection	0	J TC J (-50 ÷ +1000°C/-58 ÷ +1832°F); crAL TC K (-50 ÷ +1370°C/-58 ÷ +2498°F); S TC S (-50 ÷ 1760°C/-58 ÷ +3200°F); r TC R (-50 ÷ +1760°C/-58 ÷ +3200°F); t TC T (-70 ÷ +400°C/-94 ÷ +752°F); n TC N (-50 ...+1300°C/-58...+2372°F) Pt1 RTD Pt100 (-200 ÷ +850°C/-328 ÷ +1562°F); Pt10 RTD Pt1000 (-200 ÷ +850°C/-328 ÷ +1562°F); 0.60 0 ÷ 60 mV linear; 12.60 12 ÷ 60 mV linear; 0.20 0 ÷ 20 mA linear; 4.20 4 ÷ 20 mA linear; 0.5 0 ÷ 5 V linear; 1.5 1 ÷ 5 V linear; 0.10 0 ÷ 10 V linear; 2.10 2 ÷ 10 V linear.	J
2	dp	Decimal Point Position (linear inputs)	0	0 ÷ 3	1
		Decimal Point Position (different than linear inputs)		0/1	
3	SSC	Initial scale read-out for linear inputs	dp	-1999 ÷ 9999	0.0
4	FSc	Full Scale Readout for linear inputs	dp	-1999 ÷ 9999	999.9
5	unit	Engineer unit		°C/°F	°C
6	FiL	Digital filter on the measured value	1	0 OFF 1 ÷ 20.0 s	1.0
7	bS	PV input bias		-100 ÷ 100% of the input span	0
8	diA	-100 to 100 % of the input span		0 DI1 direct, 1 DI1 reverse	0

out group

no.	Param.	Description	Dec. Point	Values	Default
9	o1t	Output 1 type (when Out 1 is an analog output)		0-20 0 ÷ 20 mA; 4-20 4 ÷ 20 mA; 0-10 0 ÷ 10 V; 2-10 2 ÷ 10 V.	4-20
10	o1F	Out 1 function	0	nonE Output not used; r.inP Measure retransmission; r.Err Error (PV - SP) retransmission; r.SP Set point retransmission ; r.SEr Serial value retransmission.	r.inP
11	Ao1L	Initial scale value of the analog retransmission	dP	-1999 to Ao1H	-199.9
12	Ao1H	Full scale value of the analog retransmission	dP	Ao1L to 9999.	999.9
13	o3F	Out 3 function	0	NonE Output not used AL Alarm output or.bo Out-of-range or burn out indicator P.FAL Power failure indicator bo.PF Out-of-range, burn out and Power failure indicator	AL
14	o3AL	Alarms linked up with the out 3	0	0 ÷ 15 +1 Alarm 1 +2 Alarm 2 +4 Sensor Break +8 Overload on output 4	1
15	o3Ac	Out 3 action	0	dir Direct action rEU Reverse action	dir
16	o4F	Out 4 function	0	NonE Output not used AL Alarm output or.bo Out-of-range or burn out indicator P.FAL Power failure indicator bo.PF Out-of-range, burn out and Power failure indicator on Output ever ON (osed as auxiliary PWS for a transmitter)	AL

no.	Param.	Description	Dec. Point	Values	Default
17	o4AL	Alarms linked up with the out 4	0	0 ÷ 15 +1 Alarm 1 +2 Alarm 2 +4 Sensor Break +8 Overload on output 4	2
18	o4Ac	Out 4 action	0	dir Direct action rEU Reverse action dir.r Direct with reversed LED	dir

AL1 group

no.	Param.	Description	Dec. Point	Values	Default
19	AL1t	Alarm 1 type	0	nonE Alarm not used LoAb Absolute low alarm HiAb Absolute high alarm LHAo Windows alarm in alarm outside the windows LHAI Windows alarm in alarm inside the windows SE.br Sensor Break LodE Deviation low alarm (relative) HidE Deviation high alarm (relative) LHdo Relative band alarm in alarm out of the band LHdi Relative band alarm in alarm inside the band	HiAb
20	Ab1	Alarm 1 function	0	0 ÷ 3 +1 Not active at power up +2 Relative alarm not active at set point change	0
21	AL1L	- For High and low alarms AL1L is the low limit of the AL1 threshold; - For band alarm AL1L is the low alarm threshold	dp	From -1999 to AL1H (E.U.)	-199.9
22	AL1H	- For High and low alarms AL1H is the high limit of the AL1 threshold; - For band alarm AL1H is the high alarm threshold	dp	From AL1L to 9999 (E.U.)	999.9
23	AL1	AL1 threshold	dp	From AL1L to AL1H (E.U.)	0.0
24	HAL1	AL1 hysteresis	dp	1 ÷ 9999 (E.U.)	0.1
25	AL1d	AL1 delay	0	From 0 (oFF) to 9999 (s)	oFF

AL2 group

no.	Param.	Description	Dec. Point	Values	Default
26	AL2t	Alarm 2 type	0	nonE Alarm not used LoAb Absolute low alarm HiAb Absolute high alarm LHAo Windows alarm in alarm outside the windows LHAI Windows alarm in alarm inside the windows SE.br Sensor Break LodE Deviation low alarm (relative) HidE Deviation high alarm (relative) LHdo Relative band alarm in alarm out of the band LHdi Relative band alarm in alarm inside the band	LoAb
27	Ab2	Alarm 2 function	0	0 ÷ 3 +1 Not active at power up +3 Relative alarm not active at set point change	0
28	AL2L	- For High and low alarms AL2L is the low limit of the AL2 threshold; - For band alarm AL2L is the low alarm threshold	dp	From -1999 to AL2H (E.U.)	-199.9
29	AL2H	- For High and low alarms AL2H is the high limit of the AL2 threshold; - For band alarm AL2H is the high alarm threshold	dp	From AL2L to 9999 (E.U.)	999.9
30	AL2	AL2 threshold	dp	From AL2L to AL2H (E.U.)	0.0
31	HAL2	AL2 hysteresis	dp	1 ÷ 9999 (E.U.)	0.1
32	AL2d	AL2 delay	0	From 0 (oFF) to 9999 (s)	oFF

rEG group - Control Parameters

no.	Param.	Description	Dec. Point	Values	Default
33	HI.Lo	Limit Control type	0	HI High limit Lo Low limit	Hi
34	r.nd	Restart mode	0	0 Limit relay output is ON in any case (the instruemnt start in shoutdown condition) 1 Limit Relay output is OFF when, at power ON, PV does not exceed SP	0
35	HYS	Hysteresis of the control output	dP	From 0.0 to 100% of the input span in E.U.	5%
36	oP.SL	Operative display selection		0 PV and SP/SP only (lower display) 1 SP only (lower display)	0
37	SPLL	Minimum set point value	dP	From -1999 to SPHL	-199.9
38	SPHL	Maximum set point value	dP	From SPLL to 9999	999.9
39	SP	Set point	dP	From SPLL to SPLH	0.0
40	diS	The way to confirming operation	0	but By keyboard dI By digital input	but
41	tim	Duration time of the last exceeded periode (in shoutdown)	2	hh.mm	
42	Hi	Mximum measured value	dP	E.U.	
43	Lo	Mininum masured value	dP	E.U.	

PAn group - Operator HMI parameters

no.	Param.	Description	Dec. Point	Values	Default
44	PAS2	Level 2 password (limited access level)	0	- oFF (Level 2 not protected by password); - 1 ÷ 200.	20
45	PAS3	Level 3 password (complete configuration level)	0	3 ÷ 200	30
46	di.cL	Display colour		0 The display colour is used to show the exceeded condition 1 Display red (fix); 2 Display green (fix); 3 Display orange (fix).	0
47	diS.t	Display Timeout	2	- oFF (display always ON); - 0.1 ÷ 99.59 (mm.ss).	oFF

Ser group - Serial link parameters

no.	Param.	Description	Dec. Point	Values	Default
48	Add	Instrument address		- oFF - 1 ÷ 254	1
49	bAud	baud rate		1200 1200 baud 2400 2400 baud 9600 9600 baud 19.2 19200 baud 38.4 38400 baud	9600

cAL group - User calibration parameters

no.	Param.	Description	Dec. Point	Values	Default
50	A.L.P	Adjust Low Point	dP	From -1999 to (AH.P - 10) in engineering units	0.0
51	A.L.o	Adjust Low Offset	dP	-300 ÷ +300 (E.U.)	0.0
52	A.H.P	Adjust High Point	dP	From (AL.P + 10) to 9999 engineering units	999.9
53	A.H.o	Adjust High Offset	dP	-300 ÷ +300	0.0